Fracking
A climate solution or a setback for CCUS?

'Photo courtesy of Rio Tinto Coal Australia'
First, a quiz...

1. Which country has had the **greatest percentage increase in electricity** use in the last 30 years?

2. Which country has had the **greatest percentage increase in coal** use in the last 30 years?

3. Which country has had the **greatest percentage increase in CO₂ emissions** over the last 30 years?
Fossil fuel dependence

1995 (8.5 Btoe) vs 2012 (12.5 Btoe)

- Coal: 26.06%
- Gas: 22.47%
- Oil: 38.34%
- Nuclear: 6.13%
- Hydro: 6.57%

Renewables: 0.43%

- Coal: 29.90%
- Gas: 23.94%
- Oil: 33.11%
- Nuclear: 4.49%
- Hydro: 6.66%

Renewables: 1.68%

Nuclear 4.49%
China – the coal story
Non-OECD Fossil fuel Growth continues
Global Coal Power Fleet
CCS will be essential but how much?
IEA Mitigation Options for 2DS
North America uniquely placed to lead CCUS

- CCS is expensive and early deployment not commercial
- Commercial use for CO$_2$ – Enhanced Oil Recovery (CCUS)
- EOR opportunities can drive *Learning by Doing* to *Buy the Cost-down*
- Large (safe) market attracts technology providers
- Mature regulatory framework
The Fracking Revolution
**Golden Age of Gas**
 Expansion/Repeat of US Shale Boom?

<table>
<thead>
<tr>
<th>Comparison</th>
<th>USA (LOWER 48)</th>
<th>AUSTRALIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Area</td>
<td>7.7 million sq km</td>
<td>7.7 million sq km</td>
</tr>
<tr>
<td>SG Basins/Plays</td>
<td>&gt;20</td>
<td>5-8</td>
</tr>
<tr>
<td>SG Resources</td>
<td>1,161 tcf technically recoverable (EIA, 2013)</td>
<td>437 tcf technically recoverable (DoE, 2013)</td>
</tr>
<tr>
<td>SG Production</td>
<td>6.87 tcf / year (after EIA, 2011, “dry gas” only)</td>
<td>Nil</td>
</tr>
<tr>
<td>SG Wells</td>
<td>&gt; 30,000</td>
<td>5 – 10 (mainly E&amp;A)</td>
</tr>
<tr>
<td>Land rig count</td>
<td>1,692</td>
<td>16 – 20 (mainly CSG)</td>
</tr>
<tr>
<td>Frac equipment</td>
<td>756 units (JPT, 2010 – includes offshore &amp; Mexico)</td>
<td>~ 5 units (JPT, 2010)</td>
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Enabling Factors for fracking led *Shale Gale*

<table>
<thead>
<tr>
<th>Factor</th>
<th>USA</th>
<th>Australia</th>
<th>Europe</th>
<th>China</th>
<th>India</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geology</td>
<td>✔</td>
<td>✔</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Regulation</td>
<td>✔</td>
<td>✔</td>
<td>X</td>
<td>✔</td>
<td>X</td>
</tr>
<tr>
<td>Oilfield Capability</td>
<td>✔</td>
<td>-</td>
<td>X</td>
<td>✔</td>
<td>-</td>
</tr>
<tr>
<td>Landowner Resource Ownership</td>
<td>✔</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Social Licence</td>
<td>✔</td>
<td>-</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Pipelines</td>
<td>✔</td>
<td>-</td>
<td>✔</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Domestic Market</td>
<td>✔</td>
<td>-</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>
What does a limited Gas Boom mean for GHG?

USA Situation
- Domestic market
  - Capability
  - Technology & Innovation
- Unconventional Geology

US Gas Price
- US Coal Demand
- US Coal Exports
- US LNG Exports
- Global LNG Prices

Global CO₂ Emissions
- Global CO₂ Emissions
- % Gas Share of Energy Mix
1. Continued fossil fuel growth drives large scale CCS need.
2. The USA is best placed to lead early deployment.
3. *Fracking & Shale gale* takes focus and resources from CCS.
4. *Golden Age of Gas* may be limited to North America.
5. Emissions down in USA, but coal & emissions up elsewhere.